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## REMARKS

Claims in the Application. Claims 1-22 and 30-34 were previously cancelled from this application. Claims 28-29 , 35-36, 39 and 41-45 are herein cancelled from this application. All of the claims have been amended to incorporate all of the limitations of cancelled claims 41 and 42. As such, no new issues have been presented by the amendment of the claims. Accordingly, Claims 23-27 and 37-38 and 40 are active in this application. Reconsideration is respectfully requested.

Discussion of the Invention. All of the claims of Applicants are directed to a method of assisting a compromised barrier. As set forth in the attached ASTM E 814-88, *Exhibit A,* "fire spreads from one building compartment to another by the collapse of a barrier, or by openings through which flames or hot gases may pass, or by transfer of sufficient heat to ignite combustibles beyond the barrier." *See* first paragraph, Introduction, *Exhibit A*. A fire rating of 1 hour implies that a fire would be retained within the barriers of a building for 1 hour, allowing inhabitants of a building 1 hour to vacate the building.

Barriers, such as walls, floors, and ceilings, are compromised by "penetrating items" such as "cables, conduits, pipes, trays and ducts" which are placed into the walls and through the floors of buildings. Such "penetrating items" compromise the barriers by lowering the fire rating of the barrier. As reported in the second paragraph of *Exhibit A*, the prior art teaches the placement of firestop materials into openings into walls and floors created by these "penetrating items" to assist in the compromised barriers. *Exhibit A* describes the test method of measuring the resistance of firestops placed in walls and floors to resist the spread of fire.

In Applicants' invention, the compromised barriers are assisted by placement of the fire resistant gasket in an electrical box. The bridging paragraph of pages 1 and 2 of Applicants' specification discusses the compromise created by electrical boxes into such barriers as walls, floors and ceilings of buildings.

Claims 23-27 further recite "at least partially reestablishing a fire rating of the barrier." Placement of the claimed gasket into an electrical box reestablishes the fire rating (or fire resistive performance) of the barrier to its level prior to the state of compromise. ASTM E 119, *Exhibit B*, sets forth the protocol for measuring the fire resistive properties of materials and assemblies in buildings.

Request to Withdraw the Finality of the Rejection. The Examiner is requested to *withdraw* the finality of the rejection. The Examiner indicates that "Applicant's amendment necessitated the new ground(s) of rejection presented in this Office Action." (Paragraph 11.) Applicant respectfully disagrees. New grounds of rejection were applied to all of the claims active in this application. No amendments were made to Claims 23-29 in the Amendment filed on December 8, 2003. Thus, Applicant's amendment could not have "necessitated the new ground(s) of rejection" to these claims. The only amendments made to Claims 35-42 were to a "layer" of a gasket. The new ground of rejection is not drawn to this additional claimed terminology, which has now been removed, and such amendments did not necessitate the new ground of rejection. The new ground of rejection was necessitated by the impropriety of the previously made rejections of the prior art. Withdrawal of the finality of the rejection is therefore requested.

Examiner's Rejection of Claims 23-27, 35-38, 40-41, 43, and 45 Under 35 U.S.C. § 102(b) Over Tricca. The Examiner has rejected Claims 23-27, 29, 35-38, 40-41, 43 and 45 as being anticipated under 35 U.S.C. § 102(b) over U.S. Patent No. 4,293,173 ("*Tricca*"). This rejection was not applied as to Claim 42. In light of the incorporation of the limitations of Claim 42 into Claim 23 and Claim 37, it is believed that a discussion of this rejection is obviated.

Examiner's Rejection of Claims 23-29, 35-41 and 43-45 Under 35 U.S.C. § 102(e) Over Dykhoff. The Examiner has further rejected Claims 23-29, 35-41 and 43-45 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,521,834 ("*Dykhoff* "). This rejection was not applied as to Claim 42. In light of the incorporation of the limitations of Claim 42 into Claim 23 and Claim 37, it is believed that a discussion of this rejection is obviated.

Examiner's Rejection of Claims 28, 39 and 44 Under 35 U.S.C. § 103(a) Over Tricca. The Examiner has further rejected Claims 28, 39 and 44 under 35 U.S.C. § 103(a) over *Tricca*. The cancellation of Claims 28, 39 and 44 obviates the need for a discussion of this rejection.

Examiner's Rejection of Claim 42 Under 35 U.S.C. § 103(a) Over Tricca and Applicant's Admission. The Examiner has further rejected Claim 42 under 35 U.S.C. § 103(a) as being unpatentable over *Tricca* in view of Applicant's admission. This ground for rejection is traversed.

*Tricca* is directed to a thermal insulation system for an electrical outlet with "diminished heat conduction through the outlet, [providing] a barrier against moisture permeation into the wall insulation." *See* the bridging paragraph of columns 1 and 2. To safeguard against

moisture permeation and to prevent air infiltration through the outlet, *Tricca* employs a thermal insulating material composed of a resilient closed cell nitrile-PVC blend foam of "low thermal conductivity" and "thermal insulating", such as Armaflex® foam. *Tricca* does not suggest, much less disclose, a method of assisting a compromised barrier or a method of reestablishing a fire rating in a compromised barrier. There is no reason to conclude that the thermal insulating material of *Tricca* would be effective in assisting a compromised barrier or reestablish a fire rating. The thermal insulating material of *Tricca* doesn't function to reestablish the fire rating of a barrier.

The compromised barrier of Applicants' claims has a certain fire rating from one area on one side of the barrier to another area on another side of the barrier. The present invention is concerned with a method of correcting the defect (loss of fire rating) in the compromised barrier. The Examiner's reliance on lines 65-68 of column 1, lines 1-2 of column 2, lines 53-56 of column 3 and lines 9-15 of column 4 of *Tricca* for the presumptive teaching of reestablishing a fire rating of the barrier is misplaced. None of these passages recites reestablishment of a fire rating.

Applicants' own admissions merely disclose that mineral wool, ceramic fibers and intumescent graphite are known fire retardant materials. There is no reason to conclude that substitution of the materials disclosed in Applicants' specification into *Tricca* would render an effective method of assisting a compromised barrier.

In summary, the rejection should not be maintained because *Tricca* fails to disclose the methodology which is the crux of the invention. There is no reason why one of skill in the art would have been motivated to substitute the disclosed fire retardant materials for the thermal insulating material in *Tricca*, especially since *Tricca* does not disclose the use of such thermal

insulating materials to assist compromised barriers, such as in the reestablishment of fire ratings.

Examiner's Rejection of Claim 42 Under 35 U.S.C. § 103(a) Over Dykhoff and Applicant's Admission. The Examiner has further rejected Claim 42 under 35 U.S.C. § 103(a) as being unpatentable over *Dykhoff* in view of Applicants' admission. Applicants have established a date of invention prior to August 25, 2000, the effective date of *Dykhoff*. *See* Declaration Under 37 C.F.R. § 1.131 of Randy Clark. Further discussion of this rejection is therefore believed to be obviated.

Examiner's Objection to the Drawings. The Examiner has objected to the drawings under 37 CFR 1.83(a). Claim 35 and Claim 43 have been cancelled. The Examiner's objection as to Claim 35 is not understood and is therefore traversed.. Claim 35 references a gasket. The gasket is clearly labeled in the drawings as element 14. *See* line 3 of page 6 of the originally filed specification. Clarification is therefore requested.

Examiner's Rejection of the Claims Under the First Paragraph of 35 U.S.C. § 112. The Examiner has rejected Claim 35-45 under the first paragraph of 35 U.S.C. § 112. Claims 35 and 43 have been cancelled. Claim 37 has been amended. The amendment of Claim 37 and the cancellation of Claims 35 and 43 obviates the need for discussion of this rejection.

Examiner's Rejection of the Claims Under the Second Paragraph of 35 U.S.C. § 112. The Examiner has further rejected Claims 23-29, 35-36 and 43-45 under the second paragraph of 35

U.S.C. §112. This ground for rejection, as it applies to currently pending Claims 23-27, is traversed.

Lines 10-11 of page 5 of the originally filed specification defines "at least partially establishing" as "fully or partially reestablishing." The Examiner indicates that the claimed term "at least partially reestablishing a fire rating of the barrier" is confusing because partially means "fire ratings of 1, 2, 3, or 4 hours" whereas " 'a fire rating of the barrier' is minimum an hour." (Bridging paragraph of pages 3-4 of Office Action). The Examiner's rationale is not understood. The claims state that the process is capable of "at least partially reestablishing a fire rating of the barrier," i.e., partially or fully reestablishing a fire rating of 1, 2, 3, or 4 hours. Barriers typically exhibit maximum fire ratings of 1, 2, 3 or 4 hours. A 4-hour maximum rated barrier having gaskets rated for 2 hours would only be capable of partially reestablishing the fire rated barrier (for 2 hours). A 2-hour maximum rated barrier having gaskets rated for 2 hours would be capable of completely reestablishing its fire rating. Thus, the claimed terminology of "at least partially reestablishing a fire rating of the barrier" is not indefinite to those of skill in the art. Those of skill in the art would understand the terminology employed in the claims of Applicant. The issue of indefiniteness must focus on whether those skilled in the art would understand the scope of the claim when the claim is read in light of the rest of the specification. *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.*, 806 F.2d 1565, 1 USPQ2d 1081, 1088 (Fed. Cir. 1986).

**Conclusion.** The Examiner is respectfully requested to telephone the undersigned should he deem it prudent to expedite the prosecution of this application into a Notice of Allowance.

Respectfully submitted,

Date: 03/30/2004

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Date: March 30, 2004

Beth A. Sanders

Designation: E 814 – 88[ε1]

# Standard Test Method for Fire Tests of Through-Penetration Fire Stops[1]

This standard is issued under the fixed designation E 814; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

[ε1] NOTE—Paragraph 1.5 was corrected editorially in June 1993.

## INTRODUCTION

Characteristically fire spreads from one building compartment to another by the collapse of a barrier, or by openings through which flames or hot gases may pass, or by transfer of sufficient heat to ignite combustibles beyond the barrier. Test Methods E 119 describe the method to be used to measure the fire-resistive performance of these barriers.

However, various techniques of providing for the distribution of services within a structure sometimes require that openings be made in fire-resistive walls and floors to allow the passage of such penetrating items as cables, conduits, pipes, trays, and ducts through to the adjacent compartment. Fire-stop material is installed into these openings to resist the spread of fire.

The performance of through-penetration fire stops should be measured and specified according to a common standard that describes the method of fire exposure and rating criteria.

## 1. Scope

1.1 This test method is applicable to through-penetration fire stops of various materials and construction. Fire stops are intended for use in openings in fire-resistive walls and floors that are evaluated in accordance with Test Methods E 119.

1.2 Tests conducted in conformance with this test method will record fire-stop performance during the test exposure; but such tests shall not be construed to determine suitability of the fire stop for use after test exposure.

1.3 This test method considers the resistance of fire stops to an external force stimulated by a hose stream. However, this test method shall not be construed as determining the performance of the fire stop during actual fire conditions when subjected to forces such as failure of cable support systems and falling debris.

1.4 The intent of this test method is to develop data to assist others in determining the suitability of the fire stops for use where fire resistance is required.

1.5 *This standard should be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions and should not be used to describe or appraise the fire-hazard or fire-risk of materials, products, or assemblies under actual fire conditions. However, results of the test may be used as elements of a fire-hazard assessment or a fire-risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.*

1.6 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Document

2.1 *ASTM Standard:*

E 119 Test Methods for Fire Tests of Building Construction and Materials[2]

## 3. Terminology

3.1 *Definition:*

3.1.1 *fire stop*—a through-penetration fire stop is a specific construction consisting of the materials that fill the opening around penetrating items such as cables, cable trays, conduits, ducts, and pipes and their means of support through the wall or floor opening to prevent spread of fire.

3.2 *Descriptions of Terms Specific to This Standard:*

3.2.1 *test specimen*—the fire stop being tested.

3.2.2 *test assembly*—the wall or floor into which the test specimen(s) is (are) mounted or installed.

## 4. Summary of Test Method

4.1 This method of testing through-penetration fire stops exposes fire stops to a standard temperature-time fire, and to a subsequent application of a hose stream.

4.2 Ratings are established on the basis of the period of resistance to the fire exposure, prior to the first development of through openings, flaming on the unexposed surface, limiting thermal transmission criterion, and acceptable performance under application of a hose stream.

[1] This method is under the jurisdiction of Committee E-5 on Fire Standards and is the direct responsibility of Subcommittee E05.11 on Building Construction.

Current edition approved Oct. 31, 1988. Published February 1989. Originally published as E 814 – 81. Last previous edition E 814 – 83.

[2] *Annual Book of ASTM Standards*, Vol 04.07.



EXHIBIT A

## 5. Significance and Use

5.1 This test method is used to determine the performance of a fire stop with respect to exposure to a standard temperature-time fire test and hose stream test. The performance of a fire stop is dependent upon the specific assembly of materials tested including the number, type, and size of penetrations and the floors or walls in which it is installed.

5.2 Two ratings are established for each fire stop. An *F* rating is based upon flame occurrence on the unexposed surface, while the *T* rating is based upon the temperature rise as well as flame occurrence on the unexposed side of the fire stop. These ratings, together with detailed performance data such as the location of through-openings and temperatures of penetrating items are intended to be one factor in assessing performance of fire stops.

## 6. Control of Fire Tests

6.1 *Temperature-Time Curve*—The fire environment within the furnace shall be in accordance with the standard temperature-time curve shown in Fig. 1. The points on the curve that determine its character are:

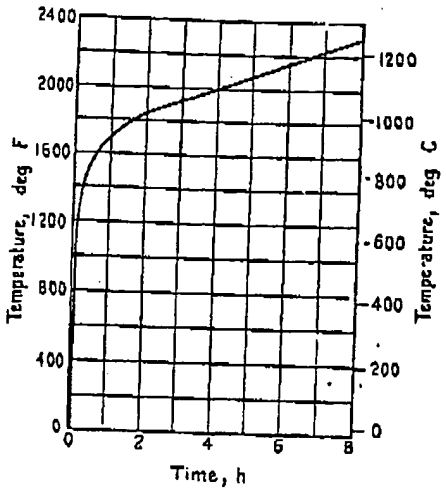
Ambient at 0 min
1000°F(538°C) at 5 min
1300°F(704°C) at 10 min
1550°F(843°C) at 30 min
1700°F(927°C) at 60 min
1850°F(1010°C) at 120 min
2000°F(1093°C) at 240 min
2300°F(1260°C) at 480 min or over

6.2 *Furnace Temperatures:*

6.2.1 The temperature fixed by the curve shall be the average temperature obtained from the readings of thermocouples symmetrically disposed and distributed within the test furnace to show the temperature near all parts of the assembly. Use a minimum of three thermocouples, with not fewer than five thermocouples per 100 ft² (9.29 m²) of floor surface, and not fewer than nine thermocouples per 100 ft² of wall specimen surface.

6.2.2 Enclose the thermocouples in sealed protection tubes of such materials and dimensions that the time constant of the protected thermocouple assembly lies within the range[3] from 300 to 400 s. The exposed length of the pyrometer tube and thermocouple in the furnace chamber shall be not less than 12 in. (300 mm). Other types of protection tubes of pyrometers may be used provided that temperature measurements obtained in accordance with Fig. 1 are within the limit of accuracy that applies for furnace temperature measurements.

6.2.3 For floors, place the junction of the thermocouples 12 in. (300 mm) away from the exposed face of the assembly. In the case of walls, place the thermocouples 6.0 in. (150 mm) away from the exposed face.




NOTE—For a closer definition of the temperature-time curve, see Annex A1.

FIG. 1 Temperature-Time Curve

6.2.4 Read the temperature at intervals not exceeding 5 min during the first 120 min. Thereafter, the intervals may be increased to not more than 10 min.

6.2.5 The accuracy of the furnace control shall be such that the area under the temperature-time curve, obtained by averaging the results from the pyrometer or thermoelectric device readings, is within 10 % of the corresponding area under the standard temperature-time curve shown in Fig. 1 for fire tests of 60 min or less duration; within 7.5 % for those over 60 min and not more than 120 min; and within 5 % for tests exceeding 120 min in duration.

6.3 *Unexposed Surface Temperatures:*

6.3.1 Make at least one measurement at each of the following locations on the unexposed surface of the test sample and floor or wall assembly as shown in Fig. 2.

6.3.2 Additional temperature measurements may be made at the discretion of the testing agency to obtain representative information on the performance of the fire stops.

6.3.3 Measure temperatures on the surface of the fire stop and assembly with thermocouples placed under flexible pads specified in Annex A2. The pads shall be held firmly against the surface and shall fit closely about the thermocouples. The thermocouple junction shall be located under the center of the pads. The thermocouple leads under the pads shall be not heavier than No. 18 B and S gage (0.040 in.) (1.02 mm) and shall be electrically insulated with heat-resistant moisture-resistant coverings.

6.3.4 Measure temperatures of each type and size of penetrating item with at least one thermocouple located 1.0 in. (25.4 mm) from the unexposed surface of the fire-stop material. The thermocouple bead shall be held firmly against the penetrating item. The thermocouple leads shall not be heavier than No. 22 B and S gage (0.025 in.) (0.635 mm) and shall be electrically insulated with heat-resistant and moisture-resistant coverings. The pads as described above shall be held firmly against the penetrating item and shall fit closely about the thermocouples.

6.3.5 Read [illegible]

[3] A typical thermocouple meeting these time-constant requirements may be fabricated by fusion-welding the twisted ends of No. 18 B and S gage (0.040 in.) (1.02 mm) Chromel-Alumel wires, mounting the leads in porcelain insulators and inserting the assembly so the thermocouple bead is 0.50 in. (13 mm) from the sealed end of a standard weight, nominal ½-in. iron, steel, or Inconel pipe. (Inconel is a trademark of Inco Alloys, Inc., 3800 Riverside Dr., P.O. Box 1958, Huntington, WV 25720.) The time constant for this and for several other thermocouple assemblies was measured in 1976. The time constant may also be calculated from knowledge of its physical and thermal properties. See Research Report RR:E05-1001, available from ASTM Headquarters.

# Standard Test Methods for Fire Tests of Building Construction and Materials[1]

This standard is issued under the fixed designation E 119; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which was adopted by the Department of Defense.*

[1]NOTE—Paragraph 1.3 and 47.1.1 were corrected editorially in June 1993.

## INTRODUCTION

The performance of walls, columns, floors, and other building members under fire exposure conditions is an item of major importance in securing constructions that are safe, and that are not a menace to neighboring structures nor to the public. Recognition of this is registered in the codes of many authorities, municipal and other. It is important to secure balance of the many units in a single building, and of buildings of like character and use in a community; and also to promote uniformity in requirements of various authorities throughout the country. To do this it is necessary that the fire-resistive properties of materials and assemblies be measured and specified according to a common standard expressed in terms that are applicable alike to a wide variety of materials, situations, and conditions of exposure.

Such a standard is found in the methods that follow. They prescribe a standard exposing fire of controlled extent and severity. Performance is defined as the period of resistance to standard exposure elapsing before the first critical point in behavior is observed. Results are reported in units in which field exposures can be judged and expressed.

The methods may be cited as the "Standard Fire Tests," and the performance or exposure shall be expressed as "2-h," "6-h," "½-h," etc.

When a factor of safety exceeding that inherent in the test conditions is desired, a proportional increase should be made in the specified time-classification period.

## 1. Scope

1.1 These test methods are applicable to assemblies of masonry units and to composite assemblies of structural materials for buildings, including bearing and other walls and partitions, columns, girders, beams, slabs, and composite slab and beam assemblies for floors and roofs. They are also applicable to other assemblies and structural units that constitute permanent integral parts of a finished building.

1.2 It is the intent that classifications shall register performance during the period of exposure and shall not be construed as having determined suitability for use after fire exposure.

1.3 *This standard should be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled conditions and should not be used to describe or appraise the fire-hazard or fire-risk of materials, products, or assemblies under actual fire conditons. However, results of the test may be used as elements of a fire-hazard assessment or a fire-risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire risk of a particular end use.*

NOTE 1—A method of fire hazard classification based on rate of flame spread is covered in Test Method E 84.

1.4 The results of these tests are one factor in assessing fire performance of building construction and assemblies. These test methods prescribe a standard fire exposure for comparing the performance of building construction assemblies. Application of these test results to predict the performance of actual building construction requires careful evaluation of test conditions.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

[1] These test methods are under the jurisdiction of ASTM Committee E-5 on Fire Standards and are the direct responsibility of Subcommittee E05.11 on Building Construction.

Current edition approved April 29, 1988. Published August 1988. Originally published as C 19 – 1917 T. Last previous edition E 119 – 87.

These test methods, of which the present standard represents a revision, were prepared by Sectional Committee A2 on Fire Tests of Materials and Construction, under the joint sponsorship of the National Bureau of Standards, the ANSI Fire Protection Group, and ASTM, functioning under the procedure of the American National Standards Institute.



**EXHIBIT B**

## 2. Referenced Documents

2.1 *ASTM Standards:*

C 569 Test Method for Indentation Hardness of Preformed Thermal Insulations[2]

E 84 Test Method for Surface Burning Characteristics of Building Materials[3]

## 3. Significance and Use

3.1 This test method is intended to evaluate the duration for which the types of assemblies noted in 1.1 will contain a fire, or retain their structural integrity or exhibit both properties dependent upon the type of assembly involved during a predetermined test exposure.

3.2 The test exposes a specimen to a *standard* fire *exposure* controlled to achieve specified temperatures throughout a specified time period. In some instances, the *fire exposure may be* followed by the application of a *specified standard* fire hose stream. The exposure, however, may not be representative of all fire conditions which may vary with changes in the amount, nature and distribution of fire loading, ventilation, compartment size and configuration, and heat sink characteristics of the compartment. It does, however, provide a relative measure of fire performance of comparable assemblies under these specified fire exposure conditions. Any variation from the construction or conditions (that is, size, method of assembly, and materials) that are tested may substantially change the performance characteristics of the assembly.

3.3 The test standard provides for the following:

3.3.1 In walls, partitions, and floor or roof assemblies:

3.3.1.1 Measurement of the transmission of heat.

3.3.1.2 Measurement of the transmission of hot gases through the assembly, sufficient to ignite cotton waste.

3.3.1.3 For load bearing elements, measurement of the load carrying ability of the *test specimen* during the test exposure.

3.3.2 For individual load bearing assemblies such as beams and columns: Measurement of the load carrying ability under the test exposure with some consideration for the end support conditions (that is, restrained or not restrained).

3.4 The test standard does not provide the following:

3.4.1 Full information as to performance of assemblies constructed with components or lengths other than those tested.

3.4.2 Evaluation of the degree by which the assembly contributes to the fire hazard by generation of smoke, toxic gases, or other products of combustion.

3.4.3 Measurement of the degree of control or limitation of *the passage of* smoke or products of combustion through the assembly.

3.4.4 Simulation of the fire behavior of joints between building elements such as floor-wall or wall-wall, etc., connections.

3.4.5 Measurement of flame spread over surface of tested element.

3.4.6 The effect of fire endurance of conventional openings in the assembly, that is, electrical receptacle outlets, plumbing pipe, etc., unless specifically provided for in the construction tested.

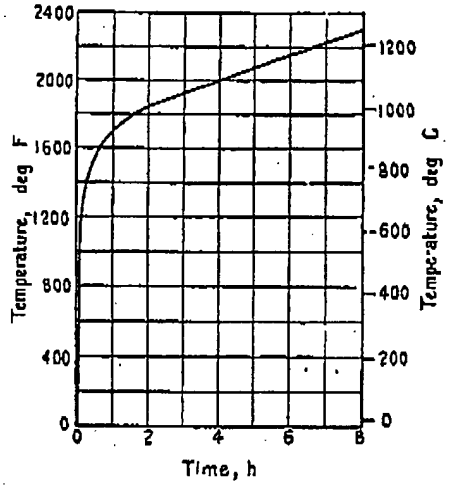



FIG. 1 Time-Temperature Curve

## CONTROL OF FIRE TESTS

## 4. Time-Temperature Curve

4.1 The conduct of fire tests of materials and construction shall be controlled by the standard time-temperature curve shown in Fig. 1. The points on the curve that determine its character are:

| | |
|---|---|
| 1000°F (538°C) | at 5 min |
| 1300°F (704°C) | at 10 min |
| 1550°F (843°C) | at 30 min |
| 1700°F (927°C) | at 1 h |
| 1850°F (1010°C) | at 2 h |
| 2000°F (1093°C) | at 4 h |
| 2300°F (1260°C) | at 8 h or over |

4.2 For a closer definition of the time-temperature curve, see Appendix X1.

NOTE 2—*Recommendations for Recording Fuel Flow to Furnace Burners*—The following provides guidance on the desired characteristics of instrumentation for recording the flow of fuel to the furnace burners. Fuel flow data may be useful for a furnace heat balance analysis, for measuring the effect of furnace or control changes, and for comparing the performance of assemblies of different properties in the fire endurance test.[4]

Record the integrated (cumulative) flow of gas (or other fuel) to the furnace burners at 10 min, 20 min, 30 min, and every 30 min thereafter or more frequently. Total gas consumed during the total test period is also to be determined. A recording flow meter has advantages over periodic readings on an instantaneous or totalizing flow meter. Select a measuring and recording system to provide flow rate readings accurate to within ± 5 %.

Report the type of fuel, its higher (gross) heating value, and the fuel flow (corrected to standard conditions of 60°F (16°C) and 30.0 in. Hg) as a function of time.

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[2] *Annual Book of ASTM Standards*, Vol 04.06.

[4] Harmathy, T. Z., "Design of Fire Test Furnaces," *Fire Technology*, Vol. 5, No. 2, May 1969, pp. 146–150; Seigel, L. G., "Effects of Furnace Design on Fire Endurance Test Results," *Fire Test Performance, ASTM STP 464*, ASTM, 1970, pp. 57–67; and Williamson, R. B., and Buchanan, A. H., "A Heat Balance